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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/668,702	09/23/2003	Keng-Chu Lin	24061.22	2195

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EXAMINER	
GEBREMARIAM, SAMUEL A	
ART UNIT	**PAPER NUMBER**
2811	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/06/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/668,702	LIN ET AL.	
	Examiner	Art Unit	
	Samuel A. Gebremariam	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17,21,24 and 25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17,21,24 and 25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Request for Continued Examination

1. A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/8/07 has been entered. An action on the RCE follows.

2. The amendment filed on 3/8/2007 has been entered.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the limitation of "depositing a first metal layer on the dielectric layer; depositing a glue layer on the dielectric layer and the first metal layer such that an interface is formed directly between the first metal layer and a lower surface of the glue layer and an interface is formed directly between the dielectric layer and a lower surface of the glue layer" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure

is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> **The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.**

Claims 12 and 21 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The limitation of "depositing a first metal layer on the dielectric layer; depositing a glue layer on the dielectric layer and the first metal layer such that an interface is formed directly between the first metal layer and a lower surface of the glue layer and an interface is formed directly between the dielectric layer

and a lower surface of the glue layer" as recited in claim 12 does not have support in the specification.

With regards to claim 21, the limitation of "forming a first metal layer on the dielectric layer; forming a glue layer on the first metal layer such that an interface is formed directly between metal of the first metal layer and a lower surface of the glue layer and an interface is formed directly between the dielectric layer and a lower surface of the glue" as recited in claim 21 does not have support in the specification. Claims 13-17 and 24 are also rejected as being dependent on rejected independent claim.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> **A person shall be entitled to a patent unless –**
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 3-6 and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Dixit et al., US patent No. 6,355,558.

Regarding claim 1, Dixit teaches (fig. 2C) a semiconductor device having a first layer (42) underlying a second layer (46), the method comprising: forming a glue layer (44, wetting layer same as a glue layer, refer to col. 4, lines 45-46, also states layer 44 also acts as a wetting/nucleation layer for subsequent metallization) directly on the first layer (42), wherein the first layer includes a metal layer (fig. 2C); performing an inter-treatment (col. 4, lines 52-62) on the glue layer (44); wherein the inter-treatment affects

the upper and lower surfaces of the glue layer and improves an adhesive interface between the glue layer and the first layer (since layer 44 is exposed to the plasma treatment the upper and lower surface of 44 are affected); and wherein the inter-treatment includes applying plasma (col. 4, lines 52-62); and depositing the second layer (46) directly onto the upper surface of the inter-treated glue layer (44), wherein the inter-treated glue layer improves the adhesion between the first (42) and the second layers (42), wherein the second layer is a metal layer (fig. 2C).

The limitations of "a method for increasing a time dependent dielectric breakdown lifetime of a semiconductor device" is not given patentable weight because a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Furthermore since Dixit teaches the same claimed process, Dixit's process is inherently capable of increasing a time dependent dielectric breakdown lifetime of the semiconductor device.

Regarding claim 3, Dixit teaches the entire claimed process of claim 1 above including the inter-treatment on the glue layer includes applying plasma to the glue layer (col. 4, lines 52-62).

Regarding claim 4, Dixit teaches the entire claimed process of claim 1 above including selecting a reacting gas, a process time, a process temperature, a process pressure, and a reacting gas flow (refer to col. 4, lines 52-62). Dixit teaches performing plasma treatment on the layer using different gases at certain plasma energy. Therefore Dixit's process inherently requires adjusting reacting gas flow as indicated by the chemical formala, chamber temperature and process time.

Regarding claim 5, Dixit teaches the entire claimed process of claim 1 above including the selected reacting gas is a hydrogen based gas (col. 4, lines 52-62).

Regarding claim 6, Dixit teaches the entire claimed process of claims 1 and 4 above including the selected reacting gas is a helium based gas (col. 4, lines 52-62).

Regarding claim 25, Dixit teaches (fig. 2C) forming a first metal layer (42); forming a glue layer (44, wetting layer, same as a glue layer, refer to col. 4, lines 45-46, states layer 44 also acts a wetting/nucleation layer for subsequent metallization) directly on the first metal layer (42), wherein the glue is an etch stop layer (TiN layer is also an etch stop layer); performing an inter-treatment on the glue layer to alter upper and lower surfaces of the glue layer (col. 4, lines 52-62) for improved adhesiveness, wherein the inter-treatment includes using plasma (col. 4, lines 52-62); and forming a second metal layer (46) on the upper surface of the glue layer (44).

The limitations of "a method for improving an interface in a semiconductor device" is not given patentable weight because a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior

art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Furthermore since Dixit teaches the same claimed process, Dixit's process is inherently capable of improving an interface in a semiconductor device.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dixit in view of Cox et al. US patent No. 5,851,927.

Dixit teaches substantially the entire claimed process of claim 1 above except explicitly stating performing a pre-treatment on the first layer before forming the glue layer.

It is conventional and also taught by Cox performing a pre-treatment process on a silicon nitride film (col. 3, lines 15-32) in order to promote adhesion between the silicon nitride layer and subsequent layers.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the pretreatment process taught by Cox in the method of Dixit in order to promote adhesion between the first layer and the glue layer.

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dixit.

Regarding claim 7, Dixit teaches substantially the entire claimed process of claims 1 and 4 above except explicitly stating that the selected process time is between approximately 1 and 100 seconds, the selected process temperature is between approximately 200 and 400° C, the selected process pressure is between approximately 0.5 and 10 torr, and the selected reacting gas flow is between approximately 100 and 2500 sccm.

Parameters such as process time, temperature, pressure and reacting gas flow in the art of semiconductor manufacturing process are subject to routine experimentation and optimization to achieve the desired film quality during device fabrication.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made adjust the process time, temperature, pressure and flow as claimed in the process of Dixit in order to form a high quality glue layer.

7. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dixit in view of Murokh et al. US patent No. 5,798,146.

Regarding claim 8, Dixit teaches substantially the entire claimed process of claim 1 above except explicitly stating performing the inter-treatment on the glue layer includes directing an electron beam towards the glue layer.

Murokh teaches (col. 1, lines 34-46) the application of electron beam on a dielectric layer in order to improve to the wettability and adhesive characteristics.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the process of applying electron beam on the dielectric layer taught by Murokh in the process of Dixit in order to improve the adhesive characteristics of the glue layer.

Regarding claim 9, Dixit teaches substantially the entire claimed process of claims 1 and 8 above including directing the electron beam towards the glue layer further comprises defining a process power and a dosage. Since applying electron beam requires using a certain amount of process power and electron beam density, the combined process of Dixit and Murokh inherently teaches defining a process power and a dosage.

Regarding claims 10 and 11, Dixit teaches substantially the entire claimed process of claims 1 and 8 above except explicitly stating that the process power is between approximately 1000 eV and 8000 eV and the dosage is between approximately 50 and 500 $\mu C/cm^2$.

Parameters such as process power and electron beam dosage in the art of semiconductor manufacturing process are subject to routine experimentation and optimization to achieve the desired film quality during device fabrication.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made adjust the process power and beam dosage as claimed in the process of Dixit in order to order to improve the adhesive characteristics of the glue layer.

Response to Arguments

8. Applicant's arguments with respect to claims 1-17, 21 and 24-25 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Samuel A. Gebremariam whose telephone number is (571)-272-1653. The examiner can normally be reached on 8:00am-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on (571) 272-1869869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SAG
April 1, 2007

Sara W Crane
Sara Crane
Primary Examiner